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<120> PROCEDURE FOR THE PREPARATION OF 1,3-PROPANEDIOL STARTING FROM A
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<213> Clostridium butyricum

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WO 01/04324 PCT/FR00/01981

agatatgota aaaaggotaa agagattgoa gataatacaa gigatgoaaa aagaaaagot 720 quattaaatg aaatagcaaa aattigitca aaagtitcag gagagggagc taaatcittic 780 tatgaagcat gtcaattatt tiggittatt catgcaataa taaatataga atctaatgga 840 cattetattt etecagetag atttgateaa tacatgtate catattatga aaatgataaa 900 aatataacag ataagtttgc tcaagaatta atagattgta tctggattaa attaaatgat 960 attaataaag taagagatga gatttcaast aaasattttg gtggttasss aatgtatsaa 1020 aaattaattg ttgggggtca aaattcagaa ggaaaagatg caactaataa agtatcatat 1080 atggcattag aagcagctgt ccatgtaaag ttgcctcagc catctttgtc agtaagaata 1140 tggaataaga ctccagatga atttttgctt agagcagcag aattaactag agaagggtta 1200 ggactteetg ettattataa tgatgaagtt attatteeag eattagttte tagaggtett 1260 acattagaag atgcaagaga ctacggaata attggatgtg ttgaaccaca aaagccagga 1320 aaaacagaag gatggcatga ttcagcattc tttaatcttg caagaatagt agagttaact 1380 ataaattotg gatttgataa aaataaacag attggaccta aaactcaaaa ttttgaagaa 1440 atgaaatcot ttgatgaatt catgaaagct tataaagctc aaatggagta ttttgtaaaa 1500 catatgtgct gtgctgataa ttgcatagat attgcacatg cagaaagagc tccattacct 1560 ttcttgtcat caatggttga taattgtatc ggaaaaggaa agagccttca agatggtggt 1620 gcagaatata acttcagtgg accacaagg: gt:ggagtag ctaatattgg agattcatta 1680 gttgcagtta aaaaaattgt gtttgatgaa aataagatta ctccttcaga attaaagaaa 1740 acattaaata atgattttaa aaattoagaa gaaatacaag sottactaaa aaatgotoot 1800 aagtttggaa atgatattga tgaagttgat aatttageta gagagggtge attagtatae 1860 tgtagagaag ttaataaata tacaaatcca aggggaggaa attttcaacc aggattatat 1920 ccatottoaa ttaatgtata ttttggaago ttaacaqgtg stactocaga tggaaggaaa 1980 teeggacaae sattagetga tggggstset seateaagag getgtgatgt atetggaest 2040 actgoagott gtaactcagt tagtaaatta gatcatttta tagottsaaa tggaacttta 2100 tttaatoaaa aattooatoo gtoagoatta aaaggtgata atggattaat gaatttatoa 2160 tcattaataa gaagttattt tgatcaaaag ggatttcatg ttcaatttaa tgtaatagat 2220 aaaaaaatat tacttgcagc acaaaaaaat cotgaaaaat atcaagattt aattgttaga 2280 gttgcaggat atagtgcaca gttcatttct ttaqataaat ctattcaaaa tgatattatt 2340 2354 gcaagaactg aacatgttat gtaa

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<211> 915

<212> ADN

<213> Clostridium butyricum

WO 01/04324 PCT/FR00/01981

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<211> 28

<212> ADN

<213> Clostridium butyricum

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tagataaaac aaacaaaaat gttattat

28

<210> 4

<211> 1158

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<213> Clostridium butyricum

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<210> 5

<211> 4953

<212> ADN

<213> Clostridium butyricum

<400> 5

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| aaggotoaaa | tattaaatgo | taaaccatgt | gttgaatcag | aaagagcaat | attaataaca | 420 |
|------------|--------------|---------------------|------------|------------|------------|------|
| gaatcattta | aacaaacaga | aggccagcca | gcaattttaa | gaagagcatt | ggcattgaaa | 480 |
| cacatacttg | aaaatatooo | tataacaatt | agagatcaag | aacttatagt | gggaagttta | 540 |
| actaaagaac | caaggtotto | acaagtattt | cctgagtttt | ctaataagtg | gttacaagat | 600 |
| gaattggata | gattaaataa | gagaactgga | gatgcattcc | aaatttcaga | agaaagtaaa | 660 |
| gaaaaattaa | aagatgtott | tgagtattgg | aatggaaaga | caacaagtga | gttagcaact | 720 |
| tcatatatga | cagaggaaac | aagagaggca | gtaaattgtg | aagtatttas | tgtaggaaac | 780 |
| tactattata | atggcgtagg | acatgtatct | gtagattatg | gaaaagtatt | aagggttgga | 840 |
| tttaatggga | ttataaatga | ggctaaggaa | caattagaaa | aaaacaggag | tatagateet | 900 |
| gattttataa | agaaagaaaa | attoctaaat | agtgttatta | teteatgega | agotgoaata | 960 |
| acatatgtaa | atagatatgc | taaaaaggct | aaagagattg | cagataatac | aagtgatgca | 1020 |
| aaaagaaaag | ctgaattaaa | tgaaatagca | aaaatttgtt | caaaagtttc | aggagagga | 1080 |
| gctaaatctt | tctatgaagc | atgtcaatta | titiggitta | ttcatgcaat | aataaatata | 1140 |
| gaatctaatg | gacattctat | ttctccagct | agatttgatc | aatacatgta | totatattat | 1200 |
| gaaaatgata | aaaatataac | agataagttt | gctcaagaat | taatagattg | tatctggatt | 1260 |
| aaattaaatg | atattaataa | agtaagagat | gagatttcaa | ctaaacattt | tggtggttac | 1320 |
| ccaatgtatc | aaaaattaat | tgttgggggt | caaaattcag | aaggaaaaga | tgcaactaat | 1380 |
| aaagtatcat | atatggcatt | agaagcagct | gtccatgtaa | agttgcctca | gedatetttg | 1440 |
| tcagtaagaa | tatggaataa | gactccagat | gaatttttgc | ttagagcagc | agaattaact | 1500 |
| agagaagggt | taggacttcc | tgottattat | aatgatgaag | ttattattcc | agcattagtt | 1560 |
| tctagaggtc | ttacattaga | agatgcaaga | gactacggaa | taattggatg | tgttgaacca | 1620 |
| caaaagccag | gaaaaacaga | aggatggcat | gattcagcat | totttaatot | tgcaagaata | 1630 |
| gtagagttaa | ctataaattc | tggatttgat | aaaaataaac | agattggacc | taaaactcaa | 1740 |
| aattttgaag | aaatgaaatc | ctttga tga a | ttcatgaaag | cttataaagc | tcaaatggag | 1800 |
| tattttgtaa | aacatatgtg | ctgtgctgat | aattgcatag | atattgcaca | tgdagaaaga | 1860 |
| gctccattac | ctitettgic | atcaatggtt | gataattgta | toggaaaagg | aaagagcett | 1920 |
| caagatggtg | gtgcagaata | taacttcagt | ggaccacaag | gtgttggagt | agctaatatt | 1930 |
| ggagattcat | tagttgcagt | taaaaaaatt | gtgtttgatg | aaaataagat | tactectica | 2040 |
| gaattaaaga | aaacattaaa | taatgatttt | aaaaattcag | aagaaataca | agoottacta | 2100 |
| aaaaatgoto | ctaaqtttqg | aaatgatatt | gatgaagttg | ataatttagc | tagagagggt | 21€0 |
| geattastat | . autętagaga | ayttaataaa | tatacaaatd | caaggggaga | aaattttcaa | 2220 |
| ccaggattat | atecatette | aatta at gta | tattttggaa | gcttaacagg | tgotactoca | 2280 |
| gatggaagga | . aatccggaca | accattaget | datggggttt | otenateaag | aggotgtgat | 2340 |
| gtatotggad | cladigoago | : ttgtaactca | gttagtaaat | tagatbattt | tatagoitea | 2400 |
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| | | | | | | |

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WO 01/04324 PCT/FR00/01981

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<211> 787

<212> PRT

<213> Clostridium butyricum

<400> 6

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Lys Ala Gln Ile Leu Asn Ala Lys Pro Cys Val Glu Ser Glu Arg Ala 20 25 30

Ile Leu Ile Thr Glu Ser Phe Lys Gln Thr Glu Gly Gln Pro Ala Ile
35 40 45

Leu Arg Arg Ala Leu Ala Leu Lys His Ile Leu Glu Asn Ile Pro Ile 50 55 60

Thr Ile Arg Asp Gln Glu Leu Ile Val Gly Ser Leu Thr Lys Glu Pro
65 70 75 80

Arg Ser Ser Gln Val Phe Pro Glu Phe Ser Asn Lys Trp Leu Gln Asp 85 90 95

Glu Leu Asp Arg Leu Asn Lys Arg Thr Gly Asp Ala Phe Gln Ile Ser 100 :05 110 Glu Glu Ser Lys Glu Lys Leu Lys Asp Val Phe Glu Tyr Trp Asn Gly Lys Thr Thr Ser Glu Leu Ala Thr Ser Tyr Met Thr Glu Glu Thr Arg Glu Ala Val Asn Cys Glu Val Phe Thr Val Gly Asn Tyr Tyr Asn Gly Val Gly His Val Ser Val Asp Tyr Gly Lys Val Leu Arg Val Gly Phe Asn Gly Ile Ile Asn Glu Ala Lys Glu Gln Leu Glu Lys Asn Arg Ser Ile Asp Pro Asp Phe Ile Lys Lys Glu Lys Phe Leu Asn Ser Val Ile Ile Ser Cys Glu Ala Ala Ile Thr Tyr Val Ash Arg Tyr Ala Lys Lys Ala Lys Glu Ile Ala Asp Asn Thr Ser Asp Ala Lys Arg Lys Ala 230 235 Glu Leu Asn Glu Ile Ala Lys Ile Cys Ser Lys Val Ser Gly Glu Gly Ala Lys Ser Phe Tyr Glu Ala Cys Gln Lea Phe Trp Phe Ile His Ala Ile Ile Asn Ile Glu Ser Asn Gly His Ser Ile Ser Fro Ala Arg Phe

Asp Gln Tyr Met Tyr Pro Tyr Tyr Glu Asn Asp Lys Asn Ile Thr Asp 300 295 290 Lys Phe Ala Gln Glu Leu Ile Asp Cys Ile Trp Ile Lys Leu Asn Asp 315 310 305 Ile Asn Lys Val Arg Asp Glu Ile Ser Thr Lys His Phe Gly Gly Tyr 330 335 325 Pro Met Tyr Gln Lys Leu Ile Val Gly Gln Asn Ser Glu Gly Lys 345 Asp Ala Thr Asn Lys Val Ser Tyr Met Ala Leu Glu Ala Ala Val His 360 . 355 Val Lys Leu Pro Gln Pro Ser Leu Sor Val Arg Ile Trp Asn Lys Thr 375 370 Pro Asp Glu Phe Leu Leu Arg Ala Ala Glu Leu Tar Arg Glu Gly Leu 395 385 390 Gly Leu Pro Ala Tyr Tyr Asn Asp Glu Val Ile Ile Pro Ala Leu Val 410 415 435 Ser Arg Gly Leu Thr Leu Glu Asp Ala Arg Asp Tyr Gly Ile Ile Gly 425 420 Cys Val Glu Pro Gln Lys Pro Gly Lys Thr Glu Gly Trp His Asp Ser 440 435 Ala Phe Phe Asn Leu Ala Arg Ile Val Glu Leu Thr Ile Asn Ser Gly 455 460 450

Phe Asp Lys Asn Lys Gln Ile Gly Pro Lys Thr Gln Asn Phe Glu Glu 47C Met Lys Ser Phe Asp Glu Phe Met Lys Ala Tyr Lys Ala Gln Met Glu Tyr Phe Val Lys His Met Cys Cys Ala Asp Asn Cys Ile Asp Ile Ala His Ala Glu Arg Ala Pro Leu Pro Phe Leu Ser Ser Met Val Asp Asn Cys Ile Gly Lys Gly Lys Ser Leu Gln Asp Gly Gly Ala Glu Tyr Asn Phe Ser Gly Pro Gln Gly Val Gly Val Ala Asn Ile Gly Asp Ser Leu Val Ala Val Lys Lys Ile Val Phe Asp Glu Asn Lys Ile Thr Pro Ser 5 Glu Leu Lys Lys Thr Leu Asn Asn Asp Phe Lys Asn Ser Glu Glu Ile Gln Ala Leu Leu Lys Asn Ala Pro Lys Phe Gly Asn Asp Ile Asp Glu Val Asp Asn Leu Ala Arg Glu Gly Ala Leu Val Tyr Cys Arg Glu Val Ash Lys Tyr Thr Ash Pro Arg Gly Gly Ash Phe G.n Pro Gly Leu Tyr

Pro Ser Ser Ile Asn Val Tyr Phe Gly Ser Leu Thr Gly Ala Thr Pro 645 650 655

Asp Gly Arg Lys Ser Gly Gln Pro Leu Ala Asp Gly Val Ser Pro Ser 660 665 670

Arg Gly Cys Asp Val Ser Gly Pro Thr Ala Ala Cys Asn Ser Val Ser 675 680 685

Lys Leu Asp His Phe Ile Ala Ser Asn Gly Thr Leu Phe Asn Gln Lys 690 695 700

Phe His Pro Ser Ala Leu Lys Gly Asp Asn Gly Leu Met Asn Leu Ser 705 710 715 720

Ser Leu Ile Arg Ser Tyr Phe Asp Gln Lys Gly Phe His Val Gln Phe 725 730 735

Asn Val Ile Asp Lys Lys Ile Leu Leu Ala Ala Gln Lys Asn Pro Glu 740 745 750

Lys Tyr Gln Asp Leu Ile Val Arg Val Ala Gly Tyr Ser Ala Gln Phe
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Ile Ser Leu Asp Lys Ser Ile Glm Asn Asp Ile Ile Ala Arg Thr Giu 770 775 780

His Val Met

785

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<211> 304

<212> PRT

<213> Clostridium butyricum

<400> 7

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Leu His Asp Gly Pro Gly Ile Arg Thr Ile Val Phe Phe Lys Gly Cys 20 25 30

Ser Met Ser Cys Leu Trp Cys Ser Asn Pro Glu Ser Gln Asp Ile Lys
35 40 45

Pro Gln Val Met Phe Asn Lys Asn Leu Cys Thr Lys Cys Gly Arg Cys
50 55 60

Lys Ser Gln Cys Lys Ser Ala Gly Ile Asp Met Asn Ser Glu Tyr Arg
65 70 75 80

Ile Asp Lys Ser Lys Cys Thr Glu Cys Thr Lys Cys Val Asp Asn Cys
85
90
95

Leu Ser Giy Ala Leu Val Ile Giu Giy Arg Asn Tyr Ser Vai Glu Asp 100 105 110

Val Ile Lys Glu Leu Lys Lys Asp Ser Val Gin Tyr Arg Arg Ser Asn 115 120 125

Gly Gly Ile Thr Leu Ser Gly Gly Glu Val Leu Leu Gln Pro Asp Phe 130 135 140 Ala Val Glu Leu Leu Lys Glu Cys Lys Ser Tyr Gly Trp His Thr Ala 150 155 Ile Glu Thr Ala Met Tyr Val Asn Ser Glu Ser Val Lys Lys Val Ile 170 165 Pro Tyr Ile Asp Leu Ala Met Ile Asp Ile Lys Ser Met Asn Asp Glu 185 180 Ile His Arg Lys Phe Thr Gly Val Ser Ash Glu Ile Ile Leu Gln Ash 195 200 205 Ile Lys Leu Ser Asp Glu Leu Ala Lys Glu Ile Ile Arg Ile Pro 215 210 Val Ile Glu Gly Phe Asn Ala Asp Leu Gln Ser Ile Gly Ala Ile Ala 225 230 235 Gln Phe Ser Lys Ser Leu Thr Asn Leu Lys Arg Ile Asp Leu Leu Pro 250 255 245 Tyr His Asn Tyr Gly Glu Asn Lys Tyr Gln Ala Ile Gly Arg Glu Tyr 260 265 270 Ser Leu Lys Glu Leu Lys Ser Pro Ser Lys Asp Lys Met Glu Arg Leu 275 290

Lys Ala Leu Val Glu The Met Gly The Pro Cys Thr The Gly Ala Glu

300

295

<210> 8

<211> 385

290

<212> PRT

<213> Clostridium butyricum

<400> 8

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Asn Ser Val Ser Val Val Gly Glu Arg Cys Lys Ile Leu Gly Gly Lys
20 25 30

Lys Ala Leu Ile Val Thr Asp Lys Phe Leu Lys Asp Met Glu Gly Gly
35 40 45

Ala Val Glu Leu Thr Val Lys Tyr Leu Lys Glu Ala Gly Leu Asp Val
50 55 60

Val Tyr Tyr Asp Gly Val Glu Pro Asn Pro Lys Asp Val Asn Val Ile
65 70 75 80

Glu Gly Leu Lys Ile Phe Lys Glu Glu Asn Cys Asp Met Ile Val Thr
85 90 95

Val Gly Gly Ser Ser His Asp Cys Gly Lys Gly Ile Gly Ile Ala 100 105 110

Ala Thr His Glu Gly Asp Leu Tyr Asp Tyr Ala Gly Ile Glu Thr Leu 115 120 125

Val Asn Pro Leu Pro Pro Ile Val Ala Val Asn Thr Thr Ala Gly Thr 130 135 140

Ala Ser Glu Leu Thr Arg His Cys Val Leu Thr Asn Thr Lys Lys Lys 145 150 155 160

Ile Lys Phe Val Ile Val Ser Trp Arg Asn Lou Pro Leu Val Ser Ile 165 170 170 Asn Asp Pro Met Leu Met Val Lys Lys Pro Ala Gly Leu Thr Ala Ala 180 185 190

Thr Gly Met Asp Ala Leu Thr His Ala Ile Glu Ala Tyr Val Ser Lys
195 200 205

Asp Ala Asn Pro Val Thr Asp Ala Ser Ala Ile Gin Ala Ile Lys Leu 210 215 220

Ile Ser Gln Asn Leu Arg Gln Ala Val Ala Leu Gly Glu Asn Leu Glu 225 230 235 240

Ala Arg Glu Asn Met Ala Tyr Ala Ser Leu Leu Ala Gly Met Ala Phe
245 250 250

Asn Asn Ala Asn Leu Gly Tyr Val His Ala Met Ala His Gln Leu Gly
260 265 270

Gly Leu Tyr Asp Met Ala His Gly Val Ala Asn Ala Met Leu Leu Pro 275 280 285

His Val Glu Arg Tyr Asn Met Leu Ser Asn Pro Lys Lys Phe Ala Asp 290 295 300

Ile Ala Glu Phe Met Gly Glu Asn Ile Ser Gly Lou Ser Val Met Glu 305 310 310 315 320

Ala Ala Glu Lys Ala Ile Asn Ala Met Phe Arg Leu Ser Glu Asp Val

Gly Ile Pro Lys Ser Lea Lys Glu Met Gly Val bys Glu Asp Pho \$340\$ \$350

PCT/FR00/01981 . 6

Glu His Met Ala Glu Leu Ala Leu Leu Asp Gly Asn Ala Phe Ser Asn 355 360

Pro Arg Lys Gly Asn Ala Lys Asp Ile Ile Asn Ile Phe Lys Ala Ala 375

380 370

Tyr

385

<210> 9

<211> 35

<212> ADN

<213> Séquence artificielle

<220>

<223> Description de la séquence artificielle:Amorce

<400> 9

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<210> 10

<211> 40

<212> ADN

<213> Séquence artificielle

<220>

<223 > Description de la séquence artificielle:Amorce

<400> 10

toddddgggg gaatddttta aatagtatta attaaraagn

40

35